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JCS50 U.S. PTO

IN THE U.S. PATENT AND TRADEMARK OFFICE  
Express Mail Label No.: EM 402 818 822 US  
Attorney Docket No.: NSP Case 5

Box Patent Application  
The Commissioner of Patents and Trademarks  
Washington, D. C. 20231

Sir:

Transmitted herewith for filing is the patent application of:

Inventor : John CAHILL

For : LAMINATE WALL STRUCTURE

Enclosed are:

- [X] Specification
- [X] Declaration or Oath
- [X] 1 Drawing Sheets [X] Formal  
[ ] Informal
- [ ] Preliminary Amendment Cancelling Claims
- [ ] Amendment Before First Office Action
- [ ] Information Disclosure Statement
- [X] 1 Verified Statement re small entity (37 CFR 1.9 and 1.27)
- [ ] Assignment, with Recordation Form Cover Sheet
- [X] Acknowledgment Postal Card
- [ ] Priority is claimed under 35 USC 119 based on \_\_\_\_
- [ ] Application No. \_\_\_, filed \_\_\_\_.
- [ ] A certified copy of the priority application is enclosed.

The filing fee is calculated as shown below, after entering any enclosed Amendment which requests entry before such calculation:

For	No. Filed	No. Extra	( ) LG Entity	RATE SM Entity	(X) Fee
Basic Fee			\$790.00	\$395.00	\$395.00
Total Claims (22 - 20 = 2)			x \$ 22.00	x \$ 11.00	22.00
Indep. Claims ( 1 - 3 = 0)			x \$ 82.00	x \$ 41.00	0.00
[ ] Multiple Dependent Claim			+ \$270.00	+ \$135.00	0.00
* * * TOTAL FILING FEE * * *					\$417.00

[X] A check for \$ 417.00 is enclosed to cover fees.

Patent Application Transmittal - Page 2

[ ] Please charge my Deposit Account No. 06-1382 in the amount of \$ \_\_\_\_\_. A duplicate of this transmittal is enclosed.

[X] The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or to credit any overpayment to Deposit Account No. 06-1382. A duplicate copy of this sheet is enclosed.

[X] Any additional filing fees required under 37 CFR 1.16

[ ] Any patent application processing fees under 37 CFR 1.17

[ ] Pursuant to 37 CFR 1.52, the enclosed application is in the form of a foreign language text:

[ ] A verified English translation is enclosed.

[ ] Please notify the undersigned of the due date for submitting a verified English translation.

[ ] An enclosed check includes the \$130.00 fee (37 CFR 1.17k) for processing a foreign language text.

Respectfully submitted,

  
\_\_\_\_\_  
Terrance F. Chapman

FLYNN, THIEL, BOUTELL & TANIS, P.C. 2026 Rambling Road Kalamazoo, MI 49008-1699 Phone: (616) 381-1156 Fax : (616) 381-5465	Dale H. Thiel David G. Boutell Ronald J. Tanis Terrance F. Chapman Mark L. Maki David S. Goldenberg Sidney B. Williams, Jr. Timothy B. Clise Liane L. Churney Mark P. Bourgeois	Reg.No. 24 323 Reg.No. 25 072 Reg.No. 22 724 Reg.No. 32 549 Reg.No. 36 589 Reg.No. 31 257 Reg.No. 24 949 Reg.No. 40 957 Reg.No. 40 694 Reg.No. 37 782
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Encl: Listed Above

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## LAMINATE WALL STRUCTURE

### FIELD OF THE INVENTION

This invention relates to a laminate wall structure  
5 which can be used in wall sheathing applications. The inventive laminate wall structure is lightweight, easy to fabricate and yet meets governmental wind load wall diaphragm requirements for manufactured housing for transverse wind loading.

10

### BACKGROUND OF THE INVENTION

Wall structures for homes and buildings in addition to having minimum mechanical strength and moisture resistance, have to be able to meet government regulations with respect to transverse wind loading. Conventional materials used in exterior wall structures are plywood, orientated strand board, fiberboard and a wall structure made of several layers of Kraft paper compressed and adhered together to form a panel. These conventional wall materials tend to be expensive, have a poor moisture resistance, are heavy and difficult to install.

U.S. Patent No. 4 082 882 discloses a fiberglass reinforced plywood structural sandwich for use as a truck, trailer, van or intermodal container wall which is made up of a fiberglass reinforced plywood plastic unit having one or both facings in the form of a sheet or film of a high-impact, weather-resistant, low-haze, non-brittle, substantially non-porous acrylic composition.

U.S. Patent No. 4 418 108 discloses a composite roofing panel made of a fibrous glass board, a layer of foamed-in-place plastic foam and a perforated sheet disposed between the board and the plastic foam. This sheet is made of a material such as paper, wax paper, or a thermoplastic film.

U.S. Patent No. 4 425 396 discloses an insulated panel made up of a rigid foam layer of a synthetic

organic polymeric foam, a protective weathering layer of a thermoplastic sheet material and a flexible backer layer of stereoreticulate material provided between the foam and the weathering layers.

5 U.S. Patent No. 5 053 265 discloses a moisture-impermeable panel having an intermediate layer of a water-swelling colloidal clay sandwiched between two layers of sheet material such as woven or nonwoven fabric or paperboard.

10 U.S. Patent No. 4 088 805 shows a reinforced thermoplastic foam sheet made up of outer layers of low density thermoplastic foam and a thermoplastic film and a central layer having a reinforcing net or net-like structure.

15 However, to date, there does not exist a lightweight laminate which can be used in exterior wall construction and is inexpensive, easy to install, has a high moisture resistance and meets government requirements with respect to transverse wind loading. The present invention was arrived at in order to satisfy these needs.

#### SUMMARY OF THE INVENTION

25 It is an object of the present invention to provide a wall laminate structure which is lightweight, easy to install, inexpensive, has a high moisture resistance and meets building code requirements with respect to transverse wind loading.

30 This and other objects of the present invention are accomplished by providing a laminate wall structure made up of a first low density layer having a density of from about 0.5 to 3 pounds per cubic foot and a second, reinforcing layer comprising a polymeric fabric, a biaxially oriented polymeric film or a fiberglass reinforced paper or plastic material laminated to the first layer. In another embodiment of the present invention, a third layer comprising a cellulosic material is laminated to the second, reinforcing layer.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a sectional view of a wall laminate structure according to a first embodiment of the present invention.

Figure 2 is a sectional view of a wall laminate structure according to a second embodiment of the present invention.

Figure 3 is a sectional view of the wall laminate structure according to the second embodiment of the present invention provided between interior and exterior wall layers.

DETAILED DESCRIPTION

Figure 1 generally illustrates a wall laminate structure 10 according to a first embodiment of the present invention and Figure 2 generally illustrates a wall laminate structure 10 according to a second embodiment of the present invention. This wall laminate structure 10 is made up of a low density layer 11 having a density of from about 0.5 to 3 pounds per cubic foot, a second, reinforcing layer 12 of a polymer fabric, a biaxially oriented polymeric film or a fiberglass reinforced paper or plastic material laminated to the low density layer 11 and, in the second embodiment of the present invention, a cellulosic layer 15 laminated to the second, reinforcing layer 12.

The low density layer 11 can be made of a foamed plastic material or low density fiberboard. As to the foamed plastic material, polystyrene, polyurethane or a urethane derivative is particularly suitable while the fiberboard can be made of cane fiber, wood fiber or cellulosic fiber.

The polymer fabric layer 12 is preferably made of a thermoplastic material such as a polyester or a polyolefin. As to the polyolefin, polyethylene and polypropylene are particularly preferred, with

polypropylene being the most preferred material. An example of the polymer fabric material 12 is Darco® by National Shelter Products. The polymer fabric layer 12 can be woven or unwoven.

5       The biaxially oriented polymeric film 12 is made of a thermoplastic material such as a polyolefin or a polyester. The polyolefin is preferably polyethylene or polypropylene. A suitable biaxially oriented polymeric film 12 for use in the present invention is Inteplus®  
10 manufactured by Inteplast of Livingston, New Jersey.

As the fiberglass reinforced paper material 12, any suitable paper material may be used as long as it possesses mechanical properties suitable for the purposes of the present invention. The fiberglass reinforced  
15 plastic material 12 can be any suitable thermoplastic material such as a polyolefin or a polyester. Particularly preferred polyolefins are polyethylene and polypropylene.

20      The cellulosic layer 15 provides additional stiffness to the wall laminate structure 10 and can be made of paper, paper fiberboard, plastic coated paper or plastic coated paper fiberboard. As to the paper, 40 pound Kraft paper is particularly preferred in the present invention. The Kraft paper can be provided with  
25 a one-half mil polyethylene coating on both sides thereof. As a coating for the fiberboard and the paper, polyethylene or polypropylene are used. The cellulosic layer 15 may be impregnated with an adhesive and/or a resin to improve the mechanical strength thereof. As to the adhesive or resin, a urethane, polyester, phenolic, epoxy, phenol-aralkyl and resorcinol resin can be used but the present invention is not limited thereto.  
30      Additionally, other additives such as plasticizers, flame retardants, lubricants and mineral fillers can be incorporated into the resin or adhesive in order to  
35 modify its properties.

If the cellulosic layer 15 is impregnated, it is preferably impregnated to a degree of from about 3 to 100% saturation. The preferred degree of impregnation is from about 25 to about 50%, with about 35% being  
5 particularly preferred. The manner of applying the resin or adhesive to the cellulosic layer 15 is not critical as long as the layer is impregnated thereby. The resin or adhesive may be applied to the cellulosic layer 15 by coating the resin and/or adhesive on the layer using in-line rolls or the cellulosic layer 15 may be pulled  
10 through a bath of the resin and/or adhesive or the resin and/or adhesive can be sprayed on the surface of the cellulosic layer.

The low density layer 11, polymer fabric layer 12  
15 and cellulosic layer 15 can be laminated together through the use of an adhesive or through heat and pressure bonding. If the cellulosic layer 15 is impregnated with a resin and/or adhesive, the polymer fabric layer 12 may be attached thereto and the resulting laminate subjected  
20 to pressure for a period of time necessary to adequately secure the polymer fabric layer 12 to the cellulosic layer 15. The low density layer 11 then may be bonded to the polymer fabric layer 12.

As shown in Figure 3, an exterior layer 16 can be  
25 laminated to the cellulosic layer 15 and an interior layer 17 can be laminated to the low density layer 11. The exterior layer 16 can be exposed to the outside environment and made of a fiberglass reinforced plastic as is typically used in the industry. However, layer 16  
30 is typically covered with a durable decorative material that is exposed to the outside environment. The interior layer 17 may be exposed to the interior environment of the wall structure and can be made of any suitable material such as a paneling material. However, layer 16  
35 typically faces a wall cavity that is filled with fiberglass batt insulation and separated from the interior environment by a gypsum wallboard. The exterior

layer 16 and the interior layer 17 can be bonded to the laminate wall structure of the present invention by any suitable means depending on the material used.

5       EXAMPLE

Negative pressure tests were performed on exterior side walls according to the present invention in order to determine their suitability as wall structures for manufactured housing. Expanded polystyrene (EPS) foamboard with woven polyethylene (PE) fabric facing surfaces were attached to framing members with 1" x 1-1/2" x 16 Ga. staples in accordance with Section 3280.401(b) of the Federal manufactured Home Construction and Safety Standards (FMHCSS).

15

TEST SPECIMEN DESCRIPTION

A.       Materials

1.       Studs: 2 x 6, Stud Grade SPF at 16" o.c.
2.       Top Plate: Single 1 x 6, Un-Graded SPF.
3.       Bottom Plate: Single 1 x 6, Un-Graded SPF.
4.       Sheathing: 3/8", EPS board with woven PE fabric facers.
5.       Siding: 0.038", DL/D4 Vinyl Siding.

25       B.       Fastening

- Top plate attached to studs with five (5) 7/16" x 1-1/2" x 16 Ga. staples per stud end.
- Sheathing fastened to studs with 1" x 1-1/2" x 16 ga. staples, angled 45 degrees at 3" o.c.
- Sheathing fastened to top and bottom plates with 1" x 1-1/2" x 16 Ga. staples at 3" o.c.
- Siding fastened to framing with 7/16" x 1-1/2" x 16 Ga. staples at 16" o.c.

35

C. Construction Steps

The 48" x 90" test sample was first assembled with 2 x 6 studs that were 88.50" long. The 1 x 6 top and bottom plates were 48" long. The sheathing material was placed on top of the framing members and fastened with staples as described above. The sheathing panels were oriented so the long side of the panels were parallel to the studs. The siding material was then placed on top of the sheathing material and fastened with staples as described above. The polyethylene sheeting (6 mil) was placed over the test fixture and between the wall framing and sheathing/siding materials. The polyethylene was carefully pleated both vertically and horizontally along the inside of the test fixture.

TEST SET UP AND PROCEDURE

The test was conducted in accordance with the ultimate load test procedures in Section 3280.401(b) of the Federal Manufactured Home Construction and Safety Standards. An 11-1/4" deep wood box was built 1" wider than the test sample. The test sample was placed horizontally in the test fixture with the sheathed side facing down. The wall top and bottom plates were securely fastened to the inside of the wood box. The wood box was then placed on a sealed steel table. The polyethylene sheeting was placed over the top of the test assembly (between the framing and the sheathing), and sealed to the table. This allows the entire surface of the wall to be exposed to the full negative loads. The polyethylene sheet was carefully pleated to prevent it from stretching too tight and picking up load as the wall deflects downward. If the pleating is not done, it may result in composite action between the polyethylene and the wall sample. The uniform load was applied by evacuating the air below the test specimen using a vacuum pump. The applied load was measured with a water

manometer capable of reading in 0.1 inch increments. The load was applied in approximate 1/4 design live load increments at 10 minute intervals until 1.25 times design load was reached. The load was then increased to 2.5 times design load or until failure occurred. The load in inches of water column was converted to pounds per square foot (psf) by using: 1 inch (of water column) = 5.2 psf. Deflections were taken using dial indicators capable of reading in 0.001" increments. The deflections were taken at the mid-points of the two center studs, and are for information purposes only.

#### TEST RESULTS

A total of three (3) specimens were tested. The descriptions of ultimate loads and types of failures observed are as follows:

	<u>TEST</u>	<u>ULTIMATE LOAD</u>	<u>MODE OF FAILURE</u>
15	#1	117.5 (PSF)	Vinyl siding and EPS board pulled over staples.
20	#2	109.2 (PSF)	Vinyl siding and EPS board pulled over staples.
	#3	119.1 (PSF)	Vinyl siding and EPS board pulled over staples.

The Average Ultimate Load = 115.3 PSF

25 The Required Horizontal Load = 38.0 PSF (For HUD Code Wind Zone II--Interior)  
The Required Horizontal Load = 46.0 PSF (For HUD Code Wind Zone III--Interior)

The Allowable Horizontal Design Load is:

(Average Ultimate Load)/(Safety Factor) = (115.3/2.5) = 46.1 PSF > 46.0 PSF

30 As such, the wall laminate structures of the present invention meet the governmental wind load wall diaphragm requirements.

Although a particularly preferred embodiment of the present invention has been disclosed in detail for illustrative purposes, it will be recognized in variations or modifications of the disclosed invention, including the use of equivalent components, lying within the scope of the present invention.

Claims:

1. A wall structure comprising a first layer having a density of about 0.5 - 3 lb./ft<sup>3</sup>, a second, 5 reinforcing layer selected from the group consisting of a polymer fabric, a biaxially oriented polymeric film or a fiberglass reinforced material.
2. The wall structure of Claim 1, additionally 10 comprising a third layer comprising a cellulosic material laminated to said second, reinforcing layer.
3. The wall structure of Claim 1, wherein said 15 first layer comprises a foamed material.
4. The wall structure of Claim 3, wherein said foamed material is an organic material.
5. The wall structure of Claim 4, wherein said 20 organic material is selected from the group consisting of polystyrene and polyurethane.
6. The wall structure of Claim 1, wherein said first layer comprises a fiberboard material.
7. The wall structure of Claim 1, wherein said 25 second, reinforcing layer is a polymer fabric made of a thermoplastic material.
8. The wall structure of Claim 7, wherein said 30 thermoplastic material is selected from the group consisting of polyethylene and polypropylene.
9. The wall structure of Claim 7, wherein the 35 polymer fabric is woven.

10. The wall structure of Claim 7, wherein the polymer fabric is unwoven.

11. The wall structure of Claim 1, wherein said  
5 second, reinforcing layer is a biaxially oriented polymeric film made of a thermoplastic material.

12. The wall structure of Claim 11, wherein the thermoplastic material is a polyolefin or a polyester.  
10

13. The wall structure of Claim 1, wherein the second, reinforcing layer is a fiberglass reinforced material.  
15

14. The wall structure of Claim 13, wherein the material is a paper or a plastic.  
20

15. The wall structure of Claim 2, wherein the cellulosic layer has a plastic film formed thereon.  
25

16. The wall structure of Claim 2, wherein the cellulosic layer is impregnated with a member selected from the group consisting of a resin, an adhesive and mixtures thereof.  
30

17. The wall structure of Claim 16, wherein said cellulosic layer is impregnated with a urethane.  
35

18. The wall structure of Claim 16, wherein said cellulosic layer is impregnated with a polyester.  
30

19. The wall structure of Claim 16, wherein said cellulosic layer is impregnated with a urethane and a polyester.  
35

20. The wall structure of Claim 16, wherein said cellulosic layer is impregnated to a degree of saturation of from about 3 to 100%.

5       21. The wall structure of Claim 16, wherein said cellulosic layer is impregnated to a degree of saturation of from about 25 to 50%.

10      22. The wall structure of Claim 16, wherein said cellulosic layer is impregnated to a degree of saturation of about 35%.

15

## LAMINATE WALL STRUCTURE

### ABSTRACT

5       A laminate wall structure which can be used as an exterior wall in manufactured housing and site built construction is made up of a low density layer having a density of from about one-half pound to three pounds per cubic foot, a second, reinforcing layer laminated to the  
10      low density layer and, optionally, a cellulosic layer laminated to the second, reinforcing layer. The low density layer is preferably a foamed polymer layer, the second, reinforcing layer is a polymer fabric, a biaxially oriented polymeric film or a fiberglass  
15      reinforced material and the cellulosic layer can be impregnated with an adhesive and/or resin in order to strengthen the laminate structure. This laminate wall structure has a low weight and yet is strong enough to meet wind zone wall diaphragm requirements for housing  
20      construction.

## DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:  
 My residence, post office address and citizenship are as stated next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

LAMINATE WALL STRUCTURE


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, the specification of which is attached hereto unless the following box is checked:

was filed on \_\_\_\_\_ as United States Application No. or PCT International Application No. \_\_\_\_\_ and was amended on \_\_\_\_\_ . (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority <u>Not Claimed</u>
(Number)	(Country)	(Day/Month/Year Filed)	<input type="checkbox"/>
_____	_____	_____	<input type="checkbox"/>
_____	_____	_____	<input type="checkbox"/>

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

_____ (Application Serial No.)	_____ (Filing Date)
_____ (Application Serial No.)	_____ (Filing Date)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as

defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Dale H. Thiel (Reg. No. 24 323), David G. Boutell (Reg. No. 25 072), Ronald J. Tanis (Reg. No. 22 724), Terryence F. Chapman (Reg. No. 32 549), Mark L. Maki (Reg. No. 36 589), David S. Goldenberg (Reg. No. 31 257), Sidney B. Williams, Jr. (Reg. No. 24 949), Timothy B. Clise (Reg. No. 40 957), Liane L. Churney (Reg. No. 40 694) and Mark P. Bourgeois (Reg. No. 37 782).

Send correspondence to: Direct telephone calls to:  
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor John CAHILL  
 Inventor's signature  Date 11/21/97  
 Residence Hudson, Ohio  
 Citizenship United States  
 Post Office Address 7628 Oxgate Court, Hudson, Ohio 44236-1833

Full name of second joint inventor, if any \_\_\_\_\_  
 Inventor's signature \_\_\_\_\_ Date \_\_\_\_\_  
 Residence \_\_\_\_\_  
 Citizenship \_\_\_\_\_  
 Post Office Address \_\_\_\_\_

(Supply similar information and signature for third and subsequent joint inventors.)

Applicant or Patentee: John CAHILL  
Serial or Patent No.: \_\_\_\_\_  
Filed or Issued: \_\_\_\_\_  
For: LAMINATE WALL STRUCTURE

Attorney's Docket No.: National Shelter Products Case 5

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) and 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled LAMINATE WALL STRUCTURE

described in

(X) the specification filed herewith  
( ) application Serial No. \_\_\_\_\_, filed \_\_\_\_\_  
( ) Patent No. \_\_\_\_\_, issued \_\_\_\_\_.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

(X) no such person, concern, or organization  
( ) persons, concerns or organizations listed below\*

\*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

Full Name \_\_\_\_\_

Address \_\_\_\_\_

( ) Individual ( ) Small Business Concern ( ) Nonprofit Organization

Full Name \_\_\_\_\_

Address \_\_\_\_\_

( ) Individual ( ) Small Business Concern ( ) Nonprofit Organization

Full Name \_\_\_\_\_

Address \_\_\_\_\_

( ) Individual ( ) Small Business Concern ( ) Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance

Verified Statement (Declaration) Claiming Small Entity Status  
(37 CFR 1.9(f) and 1.27(b)) - Independent Inventor - page 2

fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

John CAHILL

NAME OF INVENTOR

  
Signature of Inventor

11/21/97

Date

1/1

FIG. 1

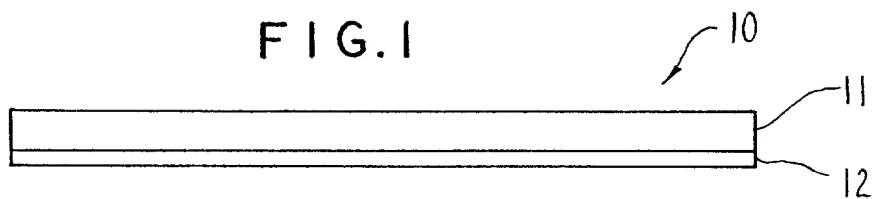


FIG. 2

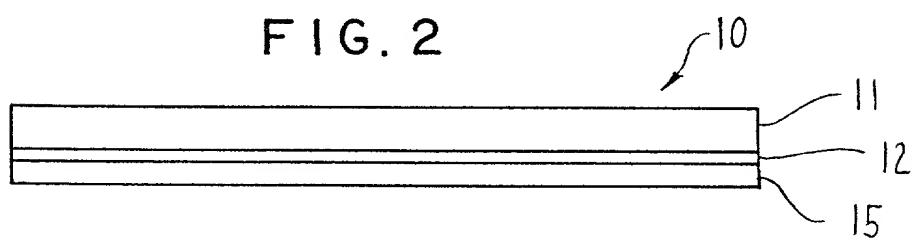


FIG. 3

